



FINAL REPORT

WATER CONSERVATION STUDY

**U.S. ARMY ALASKA (USARAK)
FT. RICHARDSON, ALASKA**

Prepared for

**U.S. ARMY ENGINEER DISTRICT
FORT RICHARDSON, ALASKA 99703**

19971022 130

Under

**U.S. ARMY ENGINEER DISTRICT, MOBILE
INDEFINITE DELIVERY A-E CONTRACT
CONTRACT NO. DACA01-94-D-0033
DELIVERY ORDER NO. 0007**

DISTRIBUTION STATEMENT E

Approved for public release
Distribution Unlimited

EMC
ENGINEERS, INC.

**DENVER, COLORADO
ATLANTA, GEORGIA**

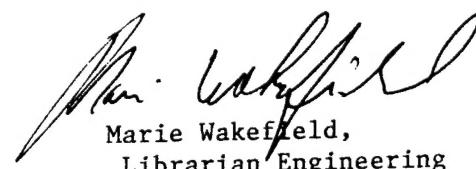


DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.
Distribution A. Approved for public release.



Marie Wakefield,
Librarian Engineering

Final Report

WATER CONSERVATION STUDY

**U.S. ARMY ALASKA (USARAK)
FT. RICHARDSON, ALASKA**

Prepared for

**U.S. Army Engineer District
Fort Richardson, Alaska 99703**

Under

**U.S. Army District, Mobile
IDIQ Contract for A-E Services
Contract No. DACA01-94-D-0033
Delivery Order No. 0007
EMC No. 1406-007**

October 1995

By

**E M C Engineers, Inc.
2750 S. Wadsworth, Suite C-200
Denver, Colorado 80227
303/988-2951**

TABLE OF CONTENTS

<i>List of Tables</i>	<i>iv</i>
<i>List of Abbreviations</i>	<i>v</i>

EXECUTIVE SUMMARY	ES-1
--------------------------------	-------------

1. INTRODUCTION	1-1
1.1 AUTHORITY FOR STUDY.....	1-1
1.2 PURPOSE OF STUDY.....	1-1
1.3 BACKGROUND.....	1-1
1.4 SCOPE OF WORK.....	1-2
1.5 APPROACH	1-2
2. DESCRIPTION OF EXISTING CONDITIONS	2-1
2.1 GENERAL.....	2-1
2.1.1 Description of Water Distribution System	2-1
2.2 LEAK DETECTION SURVEY	2-2
2.2.1 <u>Method of Analysis</u>	2-3
2.2.2 <u>Summary of Results</u>	2-3
3. WATER SYSTEM ENERGY AUDIT	3-1
3.1 ENERGY AND MAINTENANCE COSTS.....	3-1
3.2 LIFE CYCLE COST ANALYSIS METHODOLOGY.....	3-2
3.3 ENERGY CONSERVATION OPPORTUNITIES	3-3
3.3.1 <u>ECO 1: Repair Main Line Leaks</u>	3-3
3.3.2 <u>ECO 2: Repair Water Valve Leaks</u>	3-4
3.3.3 <u>ECO 3: Repair Fire Hydrant Leaks</u>	3-5
3.3.4 <u>ECO 4: Repair Main Line, Valve, and Fire Hydrant Leaks</u>	3-6
3.3.5 <u>ECO 5: Implement Leak Detection Program</u>	3-7
4. SUMMARY AND RECOMMENDATIONS	4-1
4.1 SUMMARY OF THE WATER DISTRIBUTION SYSTEM	4-1
4.2 SUMMARY OF ENERGY AUDIT	4-1
4.3 RECOMMENDATIONS	4-2
5. REFERENCES	5-1

APPENDICES

- A Scope of Work and Confirmation Notices
- B Field Notes
- C Leak Detection Survey
- D Energy Audit Calculations
- E Programming Documentation

LIST OF TABLES

TABLE ES-1. SUMMARY OF ECOs.....	ES-3
TABLE ES-2. RECOMMENDED ECOs	ES-3
TABLE 2-1. AUXILIARY PUMP SYSTEM.....	2-2
TABLE 2-2. WATER USAGE FY1994	2-2
TABLE 3-1. ECO 1 ECONOMIC ANALYSIS.....	3-4
TABLE 3-2. ECO 2 ECONOMIC ANALYSIS	3-5
TABLE 3-3. ECO 3 ECONOMIC ANALYSIS	3-6
TABLE 3-4. ECO 4 ECONOMIC ANALYSIS.....	3-7
TABLE 3-5. WATER AUDIT RESULTS	3-8
TABLE 3-6. ECO 5 ECONOMIC ANALYSIS	3-9
TABLE 4-1. SUMMARY OF ECOs.....	4-1
TABLE 4-2. RECOMMENDED ECOs	4-2

LIST OF ABBREVIATIONS

A	-	ampere
COE	-	Corps of Engineers
CY	-	cubic yards
ECIP	-	Energy Conservation Investment Program
ECO	-	Energy Conservation Opportunity
EMC	-	E M C Engineers, Inc.
F	-	Fahrenheit
ft	-	foot, feet
ft ²	-	square feet
gal	-	gallons
gpd	-	gallons per day
gpm	-	gallons per minute
hp	-	horsepower
hr	-	hour
in	-	inch
kgal	-	kilo-gallon, one thousand gallons
kW	-	kilowatt, one thousand watts
kWh	-	kilowatt-hours, one thousand watt-hours
LCCA	-	Life Cycle Cost Analysis
LF	-	linear foot (feet)
MES	-	M.E. Simpson Co., Inc.
mi	-	mile(s)
O&M	-	operation and maintenance manual
rpm	-	revolutions per minute
SIOH	-	supervision, inspection and overhead
SIR	-	Savings-to-Investment Ratio
SOW	-	scope of work
SPB	-	simple payback
UPW	-	Uniform Present Worth factor
yr	-	year(s)

EXECUTIVE SUMMARY

AUTHORIZATION FOR STUDY

This study was conducted and this report prepared under Contract No. DACA01-94-D-0033, Delivery Order No. 0007. The contract was issued by the U.S. Army Engineer District, Mobile, Alabama, to E M C Engineers, Inc. (EMC) on 15 August 1994.

PURPOSE OF STUDY

The purpose of this water conservation study is to conduct a limited site survey and evaluate energy use and savings, estimate construction costs and water savings and provide a cost-to-savings ratio associated with repairing the leaks in the domestic water distribution system at Ft. Richardson, Alaska.

METHOD OF ANALYSIS

Specific work required includes:

1. Perform a limited site survey of the potable water system to collect data required to evaluate specific energy conservation opportunities (ECOs).
2. Conduct a thorough survey of the potable water system using state-of-the-art underground leak detection equipment on all piping designated on site maps by Ft. Richardson personnel.
3. Evaluate specific ECOs to determine energy savings potential and economic feasibility associated with repairing leaks to the domestic water distribution system.
4. Provide programming documentation for recommended ECOs.
5. Prepare a report to document work performed, and to describe the results and recommendations of the site energy audit and the leak detection study.

LEAK DETECTION SURVEY

A leak detection survey was performed on all water distribution piping designated on Post site maps by Ft. Richardson personnel. The leak detection analysis was performed using a combination of listening devices and preamplified-transducer systems to identify the

majority of leak locations. When the location of the leak could not be readily identified using these methods, a leak correlator was used. The leak correlator determines leak location based on the time it takes for sound to travel from the leak to a waterline connection point.

Seventeen leaks were identified by the survey on the water mains within the project scope area. The estimated leakage of 238,000 gallons per day (gpd) was categorized into the following types of leaks:

- Five main line leaks at 216,000 gpd.
- Five valve leaks at 12,500 gpd.
- One service line leak at 3,500 gpd.
- Six fire hydrant leaks at 6,000 gpd.

ENERGY CONSERVATION OPPORTUNITIES

Approximately 15% of the water usage in the Ft. Richardson water distribution system can be attributed to leakage. ECOs were evaluated that would serve to reduce leakage, thereby reducing water production, maintenance, and energy costs.

Description of ECOs

Five ECOs were identified to reduce leakage in the process water system. These five ECOs are:

- **ECO 1.** Repair main line water leaks identified in leak detection survey. Five leaks, in pipes ranging in size from 4 to 14 inches in diameter, were identified.
- **ECO 2.** Repair water valve leaks identified in the leak detection survey. Several water valves, ranging in size from 4 to 10 inches, were found to have packing leaks and should be replaced.
- **ECO 3.** Repair fire hydrants which were found to be leaking during the leak detection survey. Six fire hydrants were found to be leaking and should be replaced.
- **ECO 4.** Repair the main line, water valve, and hydrant leaks identified above.
- **ECO 5.** Implement an annual water audit and leak detection program.

Economic Analysis

The economic analysis of the ECOs is summarized in Table ES-1 below.

Table ES-1. Summary of ECOs

ECO No.	Description	Investment Cost (\$)	Annual Water Savings*	Total Discounted Savings (\$)	SIR	Payback (yrs)
1	Repair Main Line Leaks	7,820	78.840	840,164	107.44	0.14
2	Repair Valve Leaks	15,228	4.562	48,615	3.19	4.66
3	Repair Fire Hydrant Leaks	16,908	2.190	23,338	1.38	10.78
4	Repair All Leaks	39,955	85.593	912,122	22.83	0.65
5	Implement Leak Detection	23,800	49.384	526,264	22.11	0.67

*Annual Water Savings are in units of millions of gallons saved per year

ECOs 1, 2, 4, and 5 display favorable economic payback. That is, they all have SIRs greater than 1.25 and a simple payback of 10 years or less. Based on the qualifications listed by the Scope of Work, these ECOs qualify for government energy conservation funding programs. ECO 3 does not qualify.

RECOMMENDATIONS

The ECOs listed in Table ES-2 below are recommended for implementation:

Table ES-2. Recommended ECOs

ECO No.	Description	Investment Cost (\$)	Annual Water Savings*	Total Discounted Savings (\$)	SIR	Payback (yrs)
4	Repair All Leaks	39,955	85.593	912,122	22.83	0.65
5	Implement Leak Detection	23,800	49.384	526,264	22.11	0.67

*Annual Water Savings are in units of millions of gallons saved per year

- **ECO 4.** Replace all main line, valves, and hydrant leaks identified by the leak detection survey.
- **ECO 5.** Implement a leak detection program, including a water audit, every year as recommended by AWWA Manual 36. Implement a policy to immediately excavate and repair all leaks discovered by the leak detection survey.